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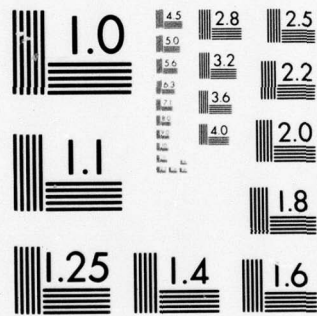UNCLASSIFIED   CNA-PROFESSIONAL PAPER-17   NL

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CORRELATES OF RETENTION AND PROMOTION FOR USNA GRADUATES

Wendi Felix

The ideas expressed in this paper are those of the author. The paper does not necessarily represent the views of either the Center for Naval Analyses or the Department of Defense.

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CORRELATES OF RETENTION AND PROMOTION FOR USNA GRADUATES

SUMMARY OF FINDINGS

The Navy spends over $70,000 to produce one officer from the Naval Academy. Later on, it spends additional money to provide these officers with graduate education. The question arises as to whether the Navy retains the top graduates and whether these graduates are more likely to be the most successful officers. Furthermore, does the Navy benefit from the graduate education it provides by retaining these officers and does this investment provide the Navy with more successful officers?

To answer these questions data was collected for all graduating members of the classes of 1947 and 1950. Retention and promotion tables were constructed and regression equations estimated. Based on the regression equations, the findings of this paper are:

1. Officers graduating in the fourth quartile appear most likely to stay to 5.5 years of service and least likely to stay beyond 10.5 years of service. Generally, officers graduating in the first quartile are most likely to stay beyond 10.5 years.

2. The relationship between graduate education and retention is unclear. For the class of 1947, officers with graduate education at year 16.5 are more likely to stay to 20.5 years of service; for the class of 1950, those with graduate education are less likely to stay to 20.5 years of service. Overall, the findings suggest a slightly negative relationship between graduate education and retention.

3.   Early promotion to Lieutenant Commander is positively related to career retention.

4.   Officers in the first quartile are more likely to be promoted to Lieutenant Commander, Commander, and Captain than officers in the fourth quartile. The difference is widest for Captain selection.

5.   The evidence suggests that possession of a graduate degree increases the likelihood of being promoted to Commander and Captain, but graduate education short of a degree does not.

6.   Early promotion to Lieutenant Commander increases an officer's probability of being promoted to Captain by over 19 percentage points.

7.   Officers from the lowest quartile are not only the most likely to fail selection and be forced out, they also appear to be the most likely to leave voluntarily after 10.5 years of service.

8.   Although officers with advanced degrees are the most likely to be promoted and permitted to continue their career, they are the most likely to leave voluntarily.

9.   There are no differences between unrestricted line, restricted line, and staff officers in promotion and retention beyond 10.5 years. Significant differences in retention were found in the early years, but caution is warranted in interpreting these results. The officer designation used in the analysis was the most recent one. Therefore, many of the officers included in the staff or restricted line may not have actually been in those categories during all the time periods.

INTRODUCTION

At present, the Navy spends over $70,000 to produce one
officer from the United States Naval Academy (reference 1). The
training at the Naval Academy is designed to prepare midshipmen
for successful careers as officers in the U.S. Navy. Students
are ranked according to how well they assimilate this training.
But do successful students become successful Naval officers in
terms of retention and promotion? If not, the Navy must recon-
sider the type of training it performs and its measure of success-
ful indoctrination.

The Navy also sends officers to graduate school for advanced
training. The Navy is concerned with the retention and promotion
record of these officers. If they do not stay in the Navy or fail
at promotion, the Navy should reconsider the value of graduate
school training to the Navy.

To examine these issues, this paper looks at the careers of
two United States Naval Academy classes: 1947 and 1950. Informa-
tion on Academy class standing at graduation, level of graduate
education, most recent officer designation, early promotion to
Lieutenant Commander, and yearly rank was collected for each
graduating member of the two classes. The study is unique in that
the two cohorts are followed through the completion or near com-
pletion of their Naval careers. Previous studies have relied on
the cross-sectional analysis of officers on active duty at a

given time, treating the cross-section as if it were a single cohort. In this study, the officers in each cohort have the same source and were exposed to the vicissitudes of war and peace, changes in Navy policy, and changes in outside economic factors at exactly the same time in their career.

Of equal interest, the data is easily accessible. The data was gleaned from three registers distributed by the Naval Academy and the Bureau of Naval Personnel. To our knowledge, these registers have not been previously used for promotion and retention analysis. The registers and the data extracted from them are discussed in appendix A.

In the first section of this paper, we cross tabulate retention and promotion rates by class standing and graduate education. Next, regression equations are estimated. Equations are estimated for retention in six intervals over an officer's career and for promotion to Lieutenant Commander, Commander, and Captain.

CROSS TABULATIONS

Retention and Promotion Rates by Class Standing

The data source records retention at the middle of the year of service. Tables 1 and 2 present retention rates at 5.5, 10.5 and 20.5 years of service by quartile for the classes of 1947 and 1950. In addition, table 1 includes retention rates at 25.5 years for the class of 1947. The fourth quartile is the most likely

TABLE 1

CLASS OF 1947 RETENTION RATES, BY QUARTILE[a]

Quartile	Years of Service[b]				
	0.5	5.5	10.5	20.5	25.5
1	1.00	.688	.550	.429	.307
	(189)	(130)	(104)	(81)	(58)
2	1.00	.667	.526	.359	.286
	(192)	(128)	(101)	(69)	(55)
3	1.00	.652	.522	.360	.253
	(178)	(116)	(93)	(64)	(45)
4	1.00	.704	.556	.302	.178
	(169)	(119)	(94)	(51)	(30)
Total Class	1.00	.677	.538	.364	.258
	(728)	(493)	(392)	(265)	(188)

TABLE 2

CLASS OF 1950[c] RETENTION RATES, BY QUARTILE

Quartile	Years of Service[b]			
	0.5	5.5	10.5	20.5
1	1.00	.794	.698	.524
	(126)	(100)	(88)	(66)
2	1.00	.676	.574	.389
	(108)	(73)	(62)	(42)
3	1.00	.667	.581	.419
	(105)	(70)	(61)	(44)
4	1.00	.808	.616	.354
	(99)	(80)	(61)	(35)
Total Class	1.00	.734	.621	.427
	(438)	(323)	(272)	(187)

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[a]Key: retention rate
(number of graduates)

[b]Academy graduation is in June. Data in reference 2 is recorded as of December 31 of each year. The first year of service is therefore recorded as being only six months long and the subsequent years represent 1-1/2 instead of 1, 2-1/2 instead of 2, etc., years of service.

[c]164 graduates in this class were commissioned in the U.S. Air Force and are not included in the analysis. Their quartile distribution was as follows: Quartile 1 = 29, Quartile 2 = 40, Quartile 3 = 47, and Quartile 4 = 48.

to remain in the Navy to 5.5 years of service. For the class of 1947, its retention is only slightly above the higher quartiles. For the class of 1950, the difference is sizeable, particularly when compared with the second and third quartiles. The fourth quartile appears to be the least likely to remain to 20.5 years of service and beyond. For both classes, retention generally declines as rank in class decreases. As we will observe later, this reflects, to some degree, poorer promotion rates of officers in the lower quartiles.

Table 3 presents promotion rates to Lieutenant Commander, Commander, and Captain by quartile for the class of 1947. To each rank, the first quartile has the highest promotion rate and the fourth quartile the lowest. The promotion rate to Lieutenant Commander varies from a high of 98% for the first quartile to a low of 88% for the fourth; to Commander it varies from a high of 89% for the first quartile to a low of 64% for the fourth; and to Captain it varies from a high of 88% for the first quartile to a low of 63% for the fourth. Table 4, for the class of 1950, confirms these findings. There is only one reversal in the positive relationship between quartile and promotion success. The third quartile does better than the second at promotion to Lieutenant Commander and Commander for both classes and to Captain for the class of 1950.

Summarizing, we see a relationship between class standing and retention in the later years, with the top quartile having the highest retention rate and the fourth quartile the lowest.

TABLE 3

CLASS OF 1947

OF THOSE STAYING 1 YEAR ABOVE ZONE, PROMOTION RATES TO LIEUTENANT COMMANDER, COMMANDER, AND CAPTAIN, BY QUARTILE[a]

Quartile	Lieutenant Commander[b]	Commander	Captain
1	.980 (95)	.890 (81)	.881 (59)
2	.920 (92)	.761 (70)	.815 (53)
3	.944 (85)	.852 (69)	.786 (44)
4	.880 (81)	.641 (50)	.630 (29)
Total Class	.931 (353)	.789 (270)	.791 (185)

TABLE 4

CLASS OF 1950

OF THOSE STAYING 1 YEAR ABOVE ZONE, PROMOTION RATES TO LIEUTENANT COMMANDER, COMMANDER, AND CAPTAIN, BY QUARTILE[a]

Quartile	Lieutenant Commander[b]	Commander	Captain
1	1.00 (88)	.914 (74)	.935 (58)
2	.935 (58)	.828 (48)	.658 (25)
3	.984 (60)	.879 (51)	.727 (32)
4	.918 (56)	.765 (39)	.567 (17)
Total Class	.963 (262)	.855 (212)	.759 (132)

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[a] Key: promotion rate (number of graduates on active duty and eligible for promotion).

[b] For Lieutenant Commander, the in-zone year is used because virtually all officers were promoted by 1 year above zone.

Those who graduated in the top quartile are most likely to be promoted to Lieutenant Commander, Commander and Captain; those who graduated in the bottom quartile are least likely.

Retention and Promotion by Graduate Education

Prior to 1962, advanced degrees were not reported in the data source. Up to that year, we know if the officer received some graduate education, but now how much or if a degree was awarded. When degrees were finally recorded, the year of the degree, if received prior to 1962, was marked as 1962. Therefore, in order to use the graduate education variable we had to use graduate education whether a degree was awarded or not. After 1962, we use both forms of graduate education, with and without degrees. Because of limited sample size, we could examine graduate education only beyond 10.5 years of service.

Table 5 displays selected retention rates by graduate education for the class of 1947. By 10.5 years, 24% of the class had some graduate training (94/388). For officers on active duty at 10.5 years, there is no difference in retention to 16.5 years between those with some graduate education and those without. There is a large difference in retention from 16.5 to 20.5 years of service between officers who received graduate education and those who did not. Officers with some graduate education, but no degree, had a 14 percentage point higher retention to 20.5 years of service than those without; officers with advanced degrees had

TABLE 5

CLASS OF 1947

RETENTION RATES OF GRADUATES AT 16.5, 20.5, AND 25.5 YEARS OF SERVICE, BY GRADUATE EDUCATION[a]

Length of Service	Active	Inactive
10.5 to 16.5[b]		
No graduate education	.884 (260)	.116 (34)
Some graduate education[c]	.883 (83)	.117 (11)
Advanced degree	-	-
10.5 to 20.5		
No graduate education	.680 (198)	.320 (93)
Some graduate education	.728 (67)	.272 (25)
Advanced degree	-	-
16.5 to 20.5		
No graduate education	.692 (117)	.308 (52)
Some graduate education	.837 (51)	.163 (10)
Advanced degree	.898 (97)	.102 (11)
20.5 to 25.5		
No graduate education	.685 (63)	.315 (29)
Some graduate education	.705 (31)	.295 (13)
Advanced degree	.734 (94)	.266 (34)

[a]Key: retention rate
(number of graduates).

[b]16.5 is the in-zone year for Commander promotion.

[c]This includes only those graduates who did not receive advanced degrees.

a 21 percentage point higher retention to 20.5 years of service than those without. Officers with advanced degrees at year 20.5 appear most likely to remain in the Navy to year 25.5.

Table 6 presents the cross tabulation of graduate education with retention for the class of 1950. Those who receive graduate education by 10.5 years of service have a slightly lower retention to year 15.5 and a 12 percentage point lower retention to year 20.5. Those receiving graduate education by the 15.5 year of service are the least likely to stay to year 20.5. Thus, the relationship of graduate education to retention beyond the Commander promotion point appears to differ for the two classes. This will be examined further in the next section.

Next, we examined the relationship between graduate education and promotion. Table 7, for the class of 1947, suggests that officers with graduate education are more likely to be promoted to Lieutenant Commander and Commander. Possession of an advanced degree enhances even further an officer's likelihood of being promoted to Commander. To Captain, officers with advanced degrees do far better than those with only some graduate education or none.

Table 8 presents promotion success by graduate education for the class of 1950. There is no relationship between promotion to Lieutenant Commander and graduate education. Of officers on active duty one year above the Commander zone, those with advanced degrees appear to have the highest promotion success; those with some graduate education the lowest. This relationship is maintained for Captain promotion. Officers with graduate education but no

TABLE 6

CLASS OF 1950

RETENTION RATES OF GRADUATES AT 15.5 AND 20.5 YEARS
OF SERVICE, BY GRADUATE EDUCATION[a]

Length of Service	Active	Inactive
10.5 to 15.5[b]		
No graduate education	.948 (127)	.052 (7)
Some graduate education[c]	.925 (124)	.075 (10)
Advanced degree		
10.5 to 20.5		
No graduate education	.769 (100)	.231 (30)
Some graduate education	.654 (87)	.346 (46)
Advanced degree		
15.5 to 20.5		
No graduate education	.800 (60)	.200 (15)
Some graduate education	.705 (43)	.295 (18)
Advanced degree	.764 (84)	.236 (26)

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[a]Key: retention rate
         (number of graduates).

[b]15.5 is the in-zone year for Commander promotion.

[c]This includes only those graduates who did not receive advanced degrees.

TABLE 7

CLASS OF 1947

OF THOSE STAYING 1 YEAR ABOVE ZONE, PROMOTION RATE TO LIEUTENANT COMMANDER, COMMANDER, AND CAPTAIN, BY GRADUATE EDUCATION[a]

	Lieutenant Commander[b]		Commander		Captain	
	Promoted	Not promoted	Promoted	Not promoted	Promoted	Not promoted
No graduate education	.912 (218)	.088 (21)	.687 (112)	.313 (51)	.724 (55)	.276 (21)
Some graduate education[c]	.964 (135)	.036 (5)	.806 (50)	.194 (12)	.706 (24)	.294 (10)
Advanced degree	-	-	.923 (108)	.077 (9)	.935 (106)	.065 (18)

[a] Key: promotion rates (number of graduates).

[b] For Lieutenant Commander, we examined in-zone promotion because virtually all officers had been promoted by one year above zone.

[c] This includes only officers who did not receive advanced degrees.

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TABLE 8

CLASS OF 1950

OF THOSE STAYING 1 YEAR ABOVE ZONE, PROMOTION RATE TO LIEUTENANT COMMANDER, COMMANDER, AND CAPTAIN, BY GRADUATE EDUCATION[a]

	Lieutenant Commander[b]		Commander		Captain	
	Promoted	Not promoted	Promoted	Not promoted	Promoted	Not promoted
No graduate education	.963 (131)	.037 (5)	.857 (66)	.143 (11)	.705 (31)	.295 (13)
Some graduate education[c]	.963 (131)	.037 (5)	.750 (42)	.250 (14)	.647 (22)	.353 (12)
Advanced degree	-	-	.904 (104)	.096 (11)	.823 (79)	.177 (17)

[a]Key: promotion rates (number of graduates).

[b]For Lieutenant Commander, we examined in-zone promotion because virtually all officers had been promoted by one year above zone.

[c]This includes only officers who did not receive advanced degrees.

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advanced degree have a 6 percentage point lower probability of being promoted, and those with advanced degrees have an 18 percentage point higher probability of being promoted than those without graduate education.

When we cross tabulated graduate education by class standing we found class standing positively related to graduate education for all promotion zones examined. The first quartile always had the greatest percentage of officers with graduate education. The percentage of officers with graduate education decreases as class standing declines. In the next section, we evaluate the relationship of graduate education to promotion and retention, holding class standing constant.

REGRESSION RESULTS

Introduction

In this section, we estimate regression equations for promotion and retention. This permits us to isolate the effects of one variable, holding other possible explanatory variables constant. The candidate explanatory variables are class standing, graduate education, designation, and below-zone promotion to Lieutenant Commander. The regression equations estimated are specified in appendix B.

Individual designations were not used because the sample sizes became very small. Instead, we divided the designations into unrestricted line, restricted line, and staff. Graduate education was defined two ways. First, it includes graduate work regardless

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of whether or not a degree was awarded. In a second set of regressions, it includes only advanced degrees. This second set of regressions covered the time periods after 1962, the first year advanced degrees are recorded.

We report regression results both with class standing as the only explanatory variable and with all independent variables included. Comparison of the results permits us to examine both the total effect of class standing and the direct effect when other variables are controlled for.

Retention Regression Findings

In all regressions, the fourth quartile is the base group. A positive (negative) coefficient for a quartile suggests it has a higher (lower) retention than the fourth quartile. When the other variables are included, unrestricted line officers, officers without graduate education, and officers not promoted early to Lieutenant Commander are the base populations.

Tables 9 and 10 present the retention regression results. When quartile is the only explanatory variable (regressions 1 through 6 in table 9 and 1 through 5 in table 10), those in the fourth quartile seem to be the most likely to stay to 5.5 years and least likely to stay beyond 10.5 years. For the class of 1950, the second and third quartiles have significantly lower retention than the fourth quartile up to year 5.5. From years 5.5 to 10.5, there appears to be no relationship between quartile and retention for the class of 1947 and a 10 percentage point higher retention rate for the top three quartiles of the class of 1950.

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TABLE 9

CLASS OF 1947

REGRESSION RESULTS FOR RETENTION RATES THROUGH 25.5 YEARS OF SERVICE[a]

	Number of cases	Length of service From To	Quartile 1	Quartile 2	Quartile 3	Restricted line	Staff	Graduate education	Advanced degree	Early promotion LCDR	Constant	R^2	MSE
1	728	0 5.5	-.016 (.33)	-.037 (.76)	-.052 (1.04)						.704	.002	.219
2	487	5.5 10.5	-.010 (.204)	-.015 (.295)	.005 (.10)						.810	.0004	.158
3	388	10.5 16.5[b]	.055 (1.20)	.074 (1.60)	.056 (1.18)						.837	.007	.103
4	338	16.5[b]20.5	.229 (3.62)*	.079 (1.26)	.129 (1.99)*						.671	.040	.164
5	383	10.5 20.5	.242 (3.66)*	.123 (1.86)	.151 (2.22)*						.560	.035	.208
6	264	20.5 25.5	.157 (1.96)*	.220 (2.66)*	.126 (1.50)						.577	.028	.202
7	728	0 5.5	-.091 (1.84)	-.067 (1.40)	-.053 (1.07)	.402 (6.19)*	.182 (3.53)*				.677	.061	.207
8	487	5.5 10.5	-.046 (.87)	-.032 (.63)	.002 (.04)	.168 (2.85)*	-.089 (1.56)				.817	.026	.153
9	388	10.5 16.5	.056 (1.10)	.071 (1.51)	.056 (1.20)	.062 (1.18)	-.078 (2.60)	-.034 (.76)			.847	.020	.102
10	338	16.5 20.5	.124 (1.75)	.014 (.21)	.083 (1.27)	-.041 (.60)	-.054 (.79)	.164 (3.23)*		.171 (1.72)	.650	.078	.160
11	383	10.5 20.5	.216 (2.94)*	.113 (1.60)	.142 (2.09)*	.087 (1.14)	-.085 (1.23)	-.051 (.80)		.221 (2.01)*	.572	.053	.206
12	264	20.5 25.5	.134 (1.49)	.208 (2.40)*	.199 (1.27)	-.040 (.48)	-.032 (.36)	.017 (.27)		.219 (1.87)	.576	.043	.202
13	338	16.5 20.5	.128 (1.76)	.023 (.34)	.099 (1.52)	-.034 (.50)	-.071 (1.03)		.153 (2.68)*	.188 (1.86)	.675	.069	.161
14	264	20.5 25.5	.130 (1.44)	.206 (2.40)*	.109 (1.29)	-.040 (.49)	-.035 (.39)		.026 (.42)	.221 (1.89)	.577	.044	.202

[a]Key: Regression coefficient
(t values)
[b]This is the year for in-zone Commander promotion.

*Significant at the .05 level.
A t-value greater than 1.96 is significant at the 5% level.
A t-value greater than 1.64 is significant at the 10% level.

TABLE 10

CLASS OF 1950

REGRESSION RESULTS FOR RETENTION RATES THROUGH 20.5 YEARS OF SERVICE[a]

	Number of cases	Length of service From	Length of service To	Quartile 1	Quartile 2	Quartile 3	Restricted line	Staff	Graduate education	Advanced degree	Constant	R^2	MSE
1	438	0	5.5	-.014 (.246)	-.132 (2.17)*	-.141 (2.31)*					.808	.022	.191
2	321	5.5	10.5	.118 (2.18)*	.111 (1.89)	.109 (1.86)					.763	.019	.129
3	268	10.5	15.5[b]	.112 (2.76)*	.083 (1.91)	.131 (3.01)*					.852	.040	.058
4	246	15.5[b]	20.5	.152 (1.98)*	.064 (.78)	.099 (1.21)					.673	.017	.183
5	263	10.5	20.5	.221 (2.93)*	.115 (1.41)	.185 (2.25)*					.574	.035	.201
6	438	0	5.5	-.066 (1.10)	-.129 (2.14)*	-.129 (2.13)*	.255 (3.75)*	-.096 (1.44)			.800	.060	.184
7	321	5.5	10.5	.085 (1.50)	.098 (1.65)	.108 (1.84)	.106 (1.78)	.053 (.74)			.755	.029	.128
8	268	10.5	15.5[b]	.119 (2.68)*	.094 (2.05)*	.133 (3.05)*	.059 (1.34)	.021 (.41)	-.057 (1.72)		.864	.054	.058
9	246	15.5	20.5	.194 (2.35)*	.103 (.12)	.116 (1.40)	-.015 (.19)	-.005 (.01)	-.096 (1.45)		.717	.027	.183
10	263	10.5	20.5	.294 (3.60)*	.179 (2.12)*	.196 (2.41)*	.060 (.74)	-.022 (.23)	-.197 (3.22)*		.625	.073	.196
11	246	15.5	20.5	.178 (2.10)*	.082 (.94)	.103 (1.24)	-.031 (.38)	-.021 (.22)		-.028 (.43)	.680	.019	.184

[a] Key: regression coefficient
(t-value)

[b] This is the year for in-zone Commander promotion.

*Significant at the .05 level.
A t-value greater than 1.96 is significant at the 5% level.
A t-value greater than 1.64 is significant at the 10% level.

Retention beyond 10.5 years of service appears to be related to class standing. Those in the fourth quartile are the least likely to remain in the Navy. Generally, those in the first quartile are the most likely to stay. The difference, however, between the first quartile and the second and third quartiles is usually smaller than the difference between these quartiles and the fourth quartile.

A link between class rank and retention has been confirmed statistically. But the reason for this link is not established. Are those in the higher quartile more likely to attend graduate school and is it merely this advanced education that is related to retention? Or is it the distribution of officers into the restricted line and staff that creates this link? Regressions 7-14 and 6-11 in tables 9 and 10, respectively, suggest that the link is more direct. When these other variables are held constant, class rank remains related to retention.

Officers in the restricted line have higher retention than officers in the unrestricted line to year 10.5 for both year groups. This relationship weakens for retention to later years. Staff officers from the class of 1947 are more likely to stay to year 5.5. For the class of 1950, on the other hand there is a sizeable, although insignificant, negative coefficient. Staff officers, in both classes, have retention similar to unrestricted line officers beyond 5.5 years. Although the majority of coefficients are negative, none are significant. Caution, however, is

warranted in interpreting these results. The officer designation assigned was the most recent one. Therefore, many of the officers included in staff or restricted line designations may not have actually been in those categories during all the time periods. This is of less concern when interpreting the later years' results.

Graduate education, when it includes graduates without advanced degrees, has an ambiguous relationship to retention. In the two cases it is significant, the effects are opposite. For the class of 1947, there is a strong positive effect from 16.5 to 20.5 years (regression 10, table 9). For the class of 1950, in general, there is a strong impression that the relationship is negative; those with graduate education are more likely to leave. For the class of 1947, defining graduate education to include advanced degrees only does not alter the findings. For the class of 1950, the negative relationship weakens.

Officers in the class of 1947 with below-zone promotion to Lieutenant Commander have a 22 percentage point higher retention from 10.5 to 20.5 years of service (regression 11, table 9). For officers on active duty at 20.5 years, early promotion to Lieutenant Commander falls slightly short of being significant at the 5% level in predicting retention to 25.5 years of service. It still shows, however, that graduates with early Lieutenant Commander promotion have a 22 percentage point higher retention rate to 25.5 years of service (regression 12). It should be noted that early promotion to Lieutenant Commander is always significant at the

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10% level. Because few officers were selected early for promotion in the class of 1950, we were not able to include this variable in that year's regressions.

In conclusion, we have found a negative relationship between class rank and retention to 5.5 years of service. Beyond 10.5 years of service, there is a consistently strong positive relationship between class rank and retention. This relationship remains intact when graduate education, early promotion to Lieutenant Commander, and designation classification (unrestricted line, restricted line or staff) are corrected for. The relationship between graduate education and retention is less clear-cut. A positive relationship exists only for retention from the Commander zone to 20.5 years for the class of 1947. In general, those with a graduate education have a slightly lower retention rate than those without graduate education. Finally, early promotion to Lieutenant Commander is positively related to career retention.

Promotion Rate Regression Findings

Regression equations were estimated for promotion rates to Lieutenant Commander, Commander, and Captain using the independent variables mentioned above. For promotion to Commander and Captain, we examined promotion rates for those graduates who were active one year above zone. For Lieutenant Commander, we examined the year the graduates were in-zone for promotion because virtually all graduates in both classes had been promoted by one year above zone.

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Tables 11 and 12 present the results. When class rank is the only independent variable, the first quartile always has significantly higher promotion rates than the fourth quartile, the difference being widest for Captain selection. Thus, for the class of 1950, of those surviving to the Lieutenant Commander zone, the first quartile had an 8 percentage point higher probability of being promoted than the fourth quartile (regression 1, table 12); of those surviving to one year past the Captain zone, the first quartile had a 37 percentage point higher probability of being promoted (regression 3, table 12). When compared with the second and third quartile, the fourth quartile always had lower promotion rates. When the other variables are added, the dominance of the top quartile remains. The magnitude of the differences declines somewhat for the class of 1947 and increases slightly for two of three of the class of 1950 regressions.

Promotion appears to be independent of our broad designation categories. None of the coefficients are significant, although most of the signs are negative.

Having graduate education generally does not increase an officer's probability of being promoted. The only exception is Commander promotion for the class of 1947. Officers in this class with graduate education had an 18 percentage point higher probability of being selected for promotion to this rank (regression 5, table 11). When only advanced degrees are considered, the variable is consistently positive. Three out of four of the coefficients are significant at the 10% level. The evidence

TABLE 11

CLASS OF 1947[a]

REGRESSION RESULTS FOR PROMOTION RATES TO LIEUTENANT COMMANDER, COMMANDER, AND CAPTAIN

	Number of cases	Rank	Quartile 1	Quartile 2	Quartile 3	Restricted officer	Staff officer	Graduate education	Advanced degree	Below zone promotion LCDR	Constant	R^2	MSE
1	379	LCDR	.099 (2.70)*	.040 (1.09)	.064 (1.72)						.880	.020	.063
2	342	CDR	.249 (4.05)*	.120 (1.95)	.211 (3.33)*						.641	.053	.159
3	234	CAPT	.250 (3.26)*	.185 (2.39)*	.155 (1.95)						.630	.046	.161
4	379	LCDR	.081 (1.99)*	.028 (.74)	.062 (1.66)	.041 (.96)	-.061 (1.55)	.019 (.63)			.884	.033	.063
5	342	CDR	.172 (2.55)*	.069 (1.09)	.177 (2.81)*	-.072 (1.08)	.006 (.10)	.175 (3.61)*			.602	.089	.155
6	234	CAPT	.182 (2.14)*	.152 (1.88)	.129 (1.60)	.086 (1.04)	-.042 (.50)	.037 (.60)		.191 (1.88)	.619	.067	.160
7	342	CDR	.166 (2.45)*	.071 (1.14)	.194 (3.11)*	-.078 (1.17)	-.020 (.29)		.196 (3.71)*		.628	.091	.154
8	234	CAPT	.162 (1.93)	.132 (1.66)	.130 (1.64)	.071 (.87)	-.057 (.67)		.101 (1.79)	.197 (1.95)	.604	.079	.158

[a]Key: regression coefficient
(t-value)

*Significant at .05 level
A t-value greater than 1.96 is significant at the 5% level.
A t-value greater than 1.64 is significant at the 10% level.

TABLE 12

CLASS OF 1950[a]

REGRESSION RESULTS FOR PROMOTION RATES TO LIEUTENANT COMMANDER, COMMANDER, AND CAPTAIN

	Number of cases	Rank	Quartile 1	Quartile 2	Quartile 3	Restricted officer	Staff officer	Graduate education	Degree	Constant	R^2	MSE
1	272	LCDR	.082 (2.64)*	.017 (.52)	.066 (1.94)					.912	.033	.035
2	248	CDR	.149 (2.38)*	.063 (.93)	.115 (1.70)					.765	.025	.123
3	174	CAPT	.369 (4.06)*	.091 (.91)	.161 (1.66)					.567	.109	.167
4	272	LCDR	.081 (2.38)*	.022 (1.89)	.067 (1.97)*	.034 (1.01)	.022 (.05)	-.020 (.87)		.922	.038	.035
5	248	CDR	.171 (2.52)*	.080 (1.13)	.120 (1.76)	-.032 (.49)	-.031 (.39)	-.027 (.51)		.779	.028	.124
6	174	CAPT	.391 (4.06)*	.095 (.91)	.160 (1.64)	-.098 (1.07)	-.035 (.30)	.045 (.59)		.545	.116	.169
7	248	CDR	.128 (1.85)	.042 (.59)	.103 (1.52)	-.080 (1.18)	-.074 (.93)		.097 (1.83)	.765	.025	.123
8	174	CAPT	.370 (3.82)*	.084 (.81)	.161 (1.66)	-.124 (1.33)	-.054 (.47)		.104 (1.51)	.537	.126	.167

[a] Key: regression coefficient
(t-value)

*Significant at .05 level
A t-value greater than 1.96 is significant at the 5% level.
A t-value greater than 1.64 is significant at the 10% level.

suggests that possession of a graduate degree increases the like-
lihood of being promoted to Commander and Captain, but graduate
education short of a degree does not.

Early promotion to Lieutenant Commander increases an officer's
probability of being promoted to Commander and Captain. The dif-
ference is sizeable, over 19 percentage points, and barely misses
significance at the 5% level.

Summarizing this section, the first quartile generally has
the highest promotion success rate and the fourth quartile the
lowest. Possession of advanced degrees appears to increase the
probability of being promoted to Commander and Captain. In addition,
early promotion to Lieutenant Commadner increases the probability
of being promoted to Commander and Captain.

Attrition: Voluntary or Involuntary

Those not retained either voluntarily leave the service or
are forced to leave because they fail promotion. For the class
of 1950, the retention points and promotion zones analyzed are
sufficiently close to determine voluntary attrition. Table 13
compares expected promotion and retention rates. The table also
points out shortcomings of our procedure. First, we violate the
constraint that a rate cannot exceed one. In the one case this
occurs, the actual rate was one so that the expected value is very
close. Second, there appears to be an inconsistency between two
of the Lieutenant Commander promotion rates and the comparable
retention rates. In the second quartile only 94.4 percent were

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TABLE 13

CLASS OF 1950 EXPECTED
PROMOTION AND RETENTION, BY QUARTILE[a]

Quartile	LCDR Promotion	10.5 to 15.5 Retention	Difference	CDR Promotion	15.5 to 20.5 Retention	Difference
I	1.003	.983	+.020	.893	.858	+.035
II	.944	.958	-.016	.807	.762	+.045
III	.989	.997	-.008	.868	.783	+.085
IV	.922	.864	+.058	.765	.680	+.085

[a]Estimates are from regression equations including designation breakdown. The Lieutenant Commander and 10.5 to 15.5 regressions include graduate education as an independent variable. The Commander and 15.5 to 20.5 regressions include advanced education as an independent variable.

promoted. Given the Navy force-out policy, these are the only officers who can stay to 15.5 years. Yet, we computed that 95.8 percent of these officers survived. We are similarly slightly off for the third quartile. Again, we did not constrain the co-efficients and this will occasionally happen.

The differences in the third and sixth columns suggest the percent of officers who could have stayed but left the Navy. To Commander, 89.3 percent of the officers one year above zone and in the top quartile had been selected for promotion. Only 85.8 percent of the officers stayed to 20.5 years of service. All those failing promotion had to leave. Thus, 3.5 percent of these officers left voluntarily. The impression one gets from the table is that officers in the lowest quartile are the most likely to leave voluntarily. Officers from the lowest quartile are, therefore, not only the most likely to fail selection and be forced out, they also appear to be the most likely to leave voluntarily.

Officers with advanced degrees are more likely to leave voluntarily. From table 14, we see that for the class of 1947 all officers without degrees who could stay did stay to 20.5 years of service. Of those with degrees, 3.4% left voluntarily. For the class of 1950, those with degrees were far more likely to leave voluntarily. Although the retention from 15.5 to 20.5 years of service differed by only 3 percentage points, the difference in voluntary attrition is 12.5 percentage points.

TABLE 14

EXPECTED
PROMOTION AND RETENTION, BY ADVANCED DEGREE[a]

	Class of 1947			Class of 1950		
	CDR Promotion	16.5 to 20.5 Retention	Difference	CDR Promotion	15.5 to 20.5 Retention	Difference
With Degree	.990	.956	+.034	.990	.830	+.160
Without Degree	.794	.803	-.009	.893	.858	+.035

[a]Rates are for unrestricted line officers who graduated in the first quartile.

Concluding Remarks

This paper set out to examine the relationship of class standing and graduate education to retention and promotion for USNA graduates. Regression equations were estimated for the classes of 1947 and 1950. We conclude that class standing is related to both retention and promotion. With regard to retention, the first quartile is more likely to stay beyond 10.5 years of service than the fourth for both classes. With respect to promotion, the first quartile has a significantly greater probability of being promoted to Lieutenant Commander, Commander, and Captain than does the fourth quartile. Possessing an advanced degree increases an officer's probability of being selected for promotion to Commander and Captain.

The study was limited to the analysis of a small set of variables. Although a number of these variables were significantly related to retention and promotion, they account for only a small portion of variances. Other variables, such as billet assignments, time at sea, and demographic characteristics would probably account for additional variance, but this data was not available.

Finally, we have not made a systematic effort to compare the two classes. The class of 1947 graduated in June 1946, just after World War II and the class of 1950 graduated at the beginning of the Korean War. It is possible that although the classes are not far apart in time, circumstances such as reductions in forces and fluctuations in the job market affected the classes at different

points in their careers and created differences in their retention
and promotion. More generally, each USNA class may have its own
unique behavior pattern. In this paper, we have sought to stress
the similarities in behavior of two classes. It should be apparent
that the similarities are great.

REFERENCES

1. <u>Financial Operations of the Five Service Academies</u>, FPCD-75-117, Comptroller General of the United States, February 6, 1975.

2. <u>Annual Register of Commissioned and Warrant Officers of the United States Navy and Reserve Officers on Active Duty</u>, Bureau of Naval Personnel.

3. <u>The Register of Alumni of the United States Naval Academy, 1845-1972</u>, The United States Naval Academy Alumni Association, Inc.

4. <u>The Annual Register of Retired Commissioned and Warrant Officers, Regular and Reserve of the United States Navy</u>, Bureau of Naval Personnel.

5. Ashenfelter, Orley, "Some Statistical Difficulties in Using Dummy Dependent Variables," Appendix A, in <u>The Economics of Labor Force Participation</u> by Bowen and Finegan, Princeton University Press, 1969.

6. Comay, Yochanan, "Influences in the Migration of Canadian Professionals," <u>Journal of Human Resources</u>, Summer 1971, pp. 333-344.

APPENDIX A

DATA BASE SPECIFICATION

The data base consists of information on every Naval Academy graduate from the class of 1947 and 1950. For each graduating member of the class, we recorded class standing, current military status information, officer designation, graduate education, and yearly rank from the year of graduation through December 1973.

The class of 1947 had 821 members and the class of 1950 had 692. We eliminated graduates who had relevant information missing, were discharged upon graduation, joined another military service, or were foreign nationals. The class of 1947 includes 37 graduates who joined the Marine Corps; the class of 1950 includes 160 graduates who joined the Air Force and 48 who joined the Marine Corps.

The data was compiled from two sources. The names and class standing of the original cohort were obtained from The Register of Alumni of the United States Naval Academy, 1845-1973. Although this book contained other information it was not complete and often contradicted what was found in the Annual Register of Commissioned and Warrant Officers of the United States Navy and Reserve Officers on Active Duty. This source was used to obtain all other data on active duty officers. For data pertaining to retirement, we used The Annual Register of Retired Commissioned and Warrant Officers, Regular and Reserve of the United States Navy.

Several of the variables in our data base need explanation and are listed below:

Class Standing

The graduating members of each class are listed according to class standing at the end of their senior year. Class standing as it appears upon graduation is the cumulative standing over four years. Each year academic subjects, aptitude, conduct, and physical education are given different weight factors and then averaged together to give a final class standing for that year.

Quartile Rank

This was determined by dividing the original number of the graduating members of the class by four prior to the elimination of any individuals.

Type of Separation

There are four types of separations:

Resigned

Retired voluntarily

Discharges of all types (honorable, dishonorable, discharge upon graduation), retired disabled, involuntary retirements

Dead or missing in action.

In the regressions, we eliminated any officer who was dead by the end of the time period under examination.

Officer Designation

The most recent designation is used.

Advanced Degree

Advance degree includes MA, MS, LLB, BD, Ph.D., MD, and DDS. For each degree awarded, the year of the degree is the first year it is listed in the Annual Register.

Annual Rank

For each year of service, the graduate's rank was recorded. Rank was obtained from the Annual Register whose information is as of December 31 of each year. Since graduation was in June, rank during the first year of service was the rank attained by six months of service. Second year rank covers the period from six months to 1-1/2 years of service and not from 1 to 2 years. This is true for all subsequent yearly ranks.

Post-Graduate Study Prior to 1962

Prior to 1962, advanced degrees were not recorded in the Annual Register. It only specifies whether the officer had done any post-graduate work of any type and specifies neither length of time of studies nor if a degree was awarded.

Year Post-Graduate Study Began

This is the first year that post-graduate study for a particular individual is listed in the Annual Register.

APPENDIX B

SPECIFICATION OF REGRESSION EQUATIONS
FOR RETENTION AND PROMOTION

The regression equation is of the form:

$$Y_i = B_{i0} + \sum_{j=1}^{7} B_{ij} X_{ij} + \varepsilon_i$$

where:

X_{i1} = 1 if graduate is in the first quartile
$\phantom{X_{i1}}$ = 0 otherwise

X_{i2} = 1 if graduate is in the second quartile
$\phantom{X_{i2}}$ = 0 otherwise

X_{i3} = 1 if graduate is in the third quartile
$\phantom{X_{i3}}$ = 0 otherwise

X_{i4} = 1 if graduate is a restricted line officer
$\phantom{X_{i4}}$ = 0 otherwise

X_{i5} = 1 if graduate is a staff officer
$\phantom{X_{i5}}$ = 0 otherwise

X_{i6} = 1 if graduate has any graduate education
$\phantom{X_{i6}}$ = 0 otherwise

X_{i7} = 1 if graduate was promoted to Lieutenant Commander
$\phantom{X_{i7}}$ below zone
$\phantom{X_{i7}}$ = 0 otherwise

and, for retention,

Y = 1 if graduate is on active duty during year in
 consideration
 = 0 otherwise

and, for promotion,

Y = 1 if graduate is promoted one year past zone (in zone
 for Lieutenant Commander)
 = 0 otherwise

We have chosen the simplest functional form to estimate the
relationships. The justification is economy and the lack of a
complete data set from which to test a complex model. But we now
have two concerns: the extent to which our variance-covariance
matrix and coefficient estimates are biased. Ashenfelter (reference 5)
has explored the bias in the variance-covariance matrix. He
assumes that the linear probability function (the one used in the
paper) is correct and then considers the implication of failing to
weight the observations. Ashenfelter concludes that ordinary least
squares is slightly more conservative, in the sense that we will
not reject the null hypothesis when there is sufficient evidence
to do so. Comay (reference 6) reports similar results. Although
these findings are encouraging, our jubilation is tempered by the
lack of theoretical justification for the direction of the bias.
We therefore chose to focus our discussion in the text on coef-
ficients significant at the 5% level.

The second area of concern is biasedness in the coefficients.
It is known that the dependent variable is always in the closed
interval from 0 to 1. Predicted values from the linear probability
function can violate this interval. Thus, the function is clearly
inappropriate. But to what extent has it biased our conclusions?

Most functions can be written to a first approximation in
linear terms. The coefficients in our regression are thus unbiased
transformations of logit or probit parameters. Including quadratic
terms suggests that if there is a bias, it is in the omission of an

interaction term. The direction, however, is uncertain. In our case, we had no prior reasons to suspect interaction nor a sufficient data base to investigate it. Also, for the regressions with only class standing as the independent variable, there is no bias because the interaction term vanishes.

PP 103
Friedheim, Robert L., "Political Aspects of Ocean Ecology" 48 pp., Feb 1973, published in Who Protects the Oceans, John Lawrence Hargrove (ed.) (St. Paul: West Publ'g. Co., 1974), published by the American Society of International Law) AD 757 936

PP 104
Schick, Jack M., "A Review of James Cable, Gunboat Diplomacy Political Applications of Limited Naval Forces," 5 pp., Feb 1973, (Reviewed in the American Political Science Review, Vol. LXVI, Dec 1972)

PP 105
Corn, Robert J. and Phillips, Gary R., "On Optimal Correction of Gunfire Errors," 22 pp., Mar 1973, AD 761 674

PP 106
Stoloff, Peter H., "User's Guide for Generalized Factor Analysis Program (FACTAN)," 35 pp., Feb 1973, (Includes an addendum published Aug 1974) AD 758 824

PP 107
Stoloff, Peter H., "Relating Factor Analytically Derived Measures to Exogenous Variables," 17 pp., Mar 1973, AD 758 820

PP 108
McConnell, James M. and Kelly, Anne M., "Superpower Naval Diplomacy in the Indo-Pakistani Crisis," 14 pp., 5 Feb 1973, (Published, with revisions, in Survival, Nov/Dec 1973) AD 761 675

PP 109
Berghoefer, Fred G., "Salaries—A Framework for the Study of Trend," 8 pp., Dec 1973, (Published in Review of Income and Wealth, Series 18, No. 4, Dec 1972)

PP 110
Augusta, Joseph, "A Critique of Cost Analysis," 9 pp., Jul 1973, AD 766 376

PP 111
Herrick, Robert W., "The USSR's 'Blue Belt of Defense' Concept: A Unified Military Plan for Defense Against Seaborne Nuclear Attack by Strike Carriers and Polaris/Poseidon SSBNs," 18 pp., May 1973, AD 766 375

PP 112
Ginsberg, Lawrence H., "ELF Atmosphere Noise Level Statistics for Project SANGUINE," 29 pp., Apr 1974, AD 786 969

PP 113
Ginsberg, Lawrence H., "Propagation Anomalies During Project SANGUINE Experiments," 5 pp., Apr 1974, AD 786 968

PP 114
Maloney, Arthur P., "Job Satisfaction and Job Turnover," 41 pp., Jul 1973, AD 768 410

PP 115
Silverman, Lester P., "The Determinants of Emergency and Elective Admissions to Hospitals," 145 pp., 18 Jul 1973, AD 766 377

PP 116
Rehm, Allan S., "An Assessment of Military Operations Research in the USSR," 19 pp., Sep 1973, (Reprinted from Proceedings, 30th Military Operations Research Symposium (U), Secret Dec 1972) AD 770 116

PP 117
McWhite, Peter B. and Ratliff, H. Donald,* "Defending a Logistics System Under Mining Attack,"** 24 pp., Aug 1976 (to be submitted for publication in Naval Research Logistics Quarterly), presented at 44th National Meeting, Operations Research Society of America, November 1973, AD A030 454
*University of Florida.
**Research supported in part under Office of Naval Research Contract N00014-68-0273-0017

PP 118
Barfoot, C. Bernard, "Markov Duels," 18 pp., Apr 1973, (Reprinted from Operations Research, Vol. 22, No. 2, Mar-Apr 1974)

PP 119
Stoloff, Peter and Lockman, Robert F., "Development of Navy Human Relations Questionnaire," 2 pp., May 1974, (Published in American Psychological Association Proceedings, 81st Annual Convention, 1973) AD 779 240

PP 120
Smith, Michael W. and Schrimper, Ronald A.,* "Economic Analysis of the Intracity Dispersion of Criminal Activity," 30 pp., Jun 1974, (Presented at the Econometric Society Meetings, 30 Dec 1973) AD 780 538
*Economics, North Carolina State University.

PP 121
Devine, Eugene J., "Procurement and Retention of Navy Physicians," 21 pp., Jun 1974, (Presented at the 49th Annual Conference, Western Economic Association, Las Vegas, Nev., 10 Jun 1974) AD 780 539

PP 122
Kelly, Anne M., "The Soviet Naval Presence During the Iraq-Kuwaiti Border Dispute: March-April 1973," 34 pp., Jun 1974, (Published in Soviet Naval Policy, ed. Michael MccGwire; New York: Praeger) AD 780 592

PP 123
Petersen, Charles C., "The Soviet Port-Clearing Operation in Bangladesh, March 1972-December 1973," 35 pp., Jun 1974, (Published in Michael MccGwire, et al. (eds) Soviet Naval Policy: Objectives and Constraints, (New York: Praeger Publishers, 1974) AD 780 540

PP 124
Friedheim, Robert L. and Jehn, Mary E., "Anticipating Soviet Behavior at the Third U.N. Law of the Sea Conference: USSR Positions and Dilemmas," 37 pp., 10 Apr 1974, (Published in Soviet Naval Policy, ed. Michael MccGwire; New York: Praeger) AD 783 701

PP 125
Weinland, Robert G., "Soviet Naval Operations—Ten Years of Change," 17 pp., Aug 1974, (Published in Soviet Naval Policy, ed. Michael MccGwire; New York: Praeger) AD 783 962

PP 126 – Classified.

PP 127
Dragnich, George S., "The Soviet Union's Quest for Access to Naval Facilities in Egypt Prior to the June War of 1967," 64 pp., Jul 1974, AD 786 318

PP 128
Stoloff, Peter and Lockman, Robert F., "Evaluation of Naval Officer Performance," 11 pp., (Presented at the 82nd Annual Convention of the American Psychological Association, 1974) Aug 1974, AD 784 012

PP 129
Holen, Arlene and Horowitz, Stanley, "Partial Unemployment Insurance Benefits and the Extent of Partial Unemployment," 4 pp., Aug 1974, (Published in the Journal of Human Resources, Vol. IX, No. 3, Summer 1974) AD 784 010

PP 130
Dismukes, Bradford, "Roles and Missions of Soviet Naval General Purpose Forces in Wartime: Pro-SSBN Operation," 20 pp., Aug 1974, AD 786 320

PP 131
Weinland, Robert G., "Analysis of Gorshkov's Navies in War and Peace," 45 pp., Aug 1974, (Published in Soviet Naval Policy, ed. Michael MccGwire; New York: Praeger) AD 786 319

PP 132
Kleinman, Samuel D., "Racial Differences in Hours Worked in the Market: A Preliminary Report," 77 pp., Feb 1975, (Paper read on 26 Oct 1974 at Eastern Economic Association Convention in Albany, N.Y.) AD A 005 517

PP 133
Squires, Michael L., "A Stochastic Model of Regime Change in Latin America," 42 pp., Feb 1975, AD A 007 912

PP 134
Root, R. M. and Cunniff, P. F.,* "A Study of the Shock Spectrum of a Two-Degree-of-Freedom Nonlinear Vibratory System," 39 pp., Dec 1975, (Published in the condensed version of The Journal of the Acoustic Society, Vol 60, No. 6, Dec 1976, pp. 1314
*Department of Mechanical Engineering, University of Maryland.

PP 135
Goudreau, Kenneth A.; Kuzmack, Richard A.; Wiedemann, Karen, "Analysis of Closure Alternatives for Naval Stations and Naval Air Stations," 47 pp., 3 Jun 1975 (Reprinted from "Hearing before the Subcommittee on Military Construction of the Committee on Armed Service," U.S. Senate, 93rd Congress, 1st Session, Part 2, 22 Jun 1973)

PP 136
Stallings, William, "Cybernetics and Behavior Therapy," 13 pp., Jun 1975

PP 137
Petersen, Charles C., "The Soviet Union and the Reopening of the Suez Canal: Mineclearing Operations in the Gulf of Suez," 30 pp., Aug 1975, AD A 015 376

*CNA Professional Papers with an AD number may be obtained from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151. Other papers are available from the author at the Center for Naval Analyses, 1401 Wilson Boulevard, Arlington, Virginia 22209.

PP 138
Stallings, William, "BRIDGE: An Interactive Dialogue-Generation Facility," 5 pp., Aug 1975 (Reprinted from IEEE Transactions on Systems, Man, and Cybernetics, Vol. 5, No. 3, May 1975)

PP 139
Morgan, William F., Jr., "Beyond Folklore and Fables in Forestry to Positive Economics," 14 pp., (Presented at Southern Economic Association Meetings November, 1974) Aug 1975, AD A 015 293

PP 140
Mahoney, Robert and Druckman, Daniel*, "Simulation, Experimentation, and Context," 36 pp., 1 Sep 1975, (Published in Simulation & Games, Vol. 6, No. 3, Sep 1975)
*Mathematica, Inc.

PP 141
Mizrahi, Maurice M., "Generalized Hermite Polynomials,"* 5 pp., Feb 1976 (Reprinted from the Journal of Computational and Applied Mathematics, Vol. 1, No. 4 (1975), 273-277).
*Research supported by the National Science Foundation

PP 142
Lockman, Robert F., Jehn, Christopher, and Shughart, William F. II, "Models for Estimating Premature Losses and Recruiting District Performance," 36 pp., Dec 1975 (Presented at the RAND Conference on Defense Manpower, Feb 1976; to be published in the conference proceedings) AD A 020 443

PP 143
Horowitz, Stanley and Sherman, Allan (LCdr., USN), "Maintenance Personnel Effectiveness in the Navy," 33 pp., Jan 1976 (Presented at the RAND Conference on Defense Manpower, Feb 1976; to be published in the conference proceedings) AD A021 581

PP 144
Durch, William J., "The Navy of the Republic of China — History, Problems, and Prospects," 66 pp., Aug 1976 (To be published in "A Guide to Asiatic Fleets," ed. by Barry M. Blechman; Naval Institute Press) AD A030 460

PP 145
Kelly, Anne M., "Port Visits and the "Internationalist Mission" of the Soviet Navy," 36 pp., Apr 1976 AD A023 436

PP 146
Palmour, Vernon E., "Alternatives for Increasing Access to Scientific Journals," 6 pp., Apr 1975 (Presented at the 1975 IEEE Conference on Scientific Journals, Cherry Hill, N.C., Apr 28-30; published in IEEE Transactions on Professional Communication, Vol. PC-18, No. 3, Sep 1975) AD A021 798

PP 147
Kessler, J. Christian, "Legal Issues in Protecting Offshore Structures," 33 pp., Jun 1976 (Prepared under task order N00014-68-A-0091-0023 for ONR) AD A028 389

PP 148
McConnell, James M., "Military-Political Tasks of the Soviet Navy in War and Peace," 62 pp., Dec 1975 (Published in Soviet Oceans Development Study of Senate Commerce Committee October 1976) AD A022 590

PP 149
Squires, Michael L., "Counterforce Effectiveness: A Comparison of the Tsipis "K" Measure and a Computer Simulation," 24 pp., Mar 1976 (Presented at the International Study Association Meetings, 27 Feb 1976) AD A022 591

PP 150
Kelly, Anne M. and Petersen, Charles, "Recent Changes in Soviet Naval Policy: Prospects for Arms Limitations in the Mediterranean and Indian Ocean," 28 pp., Apr 1976, AD A 023 723

PP 151
Horowitz, Stanley A., "The Economic Consequences of Political Philosophy," 8 pp., Apr 1976 (Reprinted from Economic Inquiry, Vol. XIV, No. 1, Mar 1976)

PP 152
Mizrahi, Maurice M., "On Path Integral Solutions of the Schrodinger Equation, Without Limiting Procedure,"* 10 pp., Apr 1976 (Reprinted from Journal of Mathematical Physics, Vol. 17, No. 4 (Apr 1976), 566-575).
*Research supported by the National Science Foundation

PP 153
Mizrahi, Maurice M., "WKB Expansions by Path Integrals, With Applications to the Anharmonic Oscillator,"* 137 pp., May 1976 (Submitted for publication in Annals of Physics). AD A025 440
*Research supported by the National Science Foundation

PP 154
Mizrahi, Maurice M., "On the Semi-Classical Expansion in Quantum Mechanics for Arbitrary Hamiltonians," 19 pp., May 1976 (To appear in the Journal of Mathematical Physics) AD A025 441

PP 155
Squires, Michael L., "Soviet Foreign Policy and Third World Nations," 26 pp., Jun 1976 (Prepared for presentation at the Midwest Political Science Association meetings, Apr 30, 1976) AD A028 388

PP 156
Stallings, William, "Approaches to Chinese Character Recognition," 12 pp., Jun 1976 (Reprinted from Pattern Recognition (Pergamon Press), Vol. 8, pp. 87-98, 1976) AD A028 692

PP 157
Morgan, William F., "Unemployment and the Pentagon Budget: Is There Anything in the Empty Pork Barrel?" 20 pp., Aug 1976 AD A030 455

PP 158
Haskell, LCdr. Richard D. (USN), "Experimental Validation of Probability Predictions," 25 pp., Aug 1976 (Presented at the Military Operations Research Society Meeting, Fall 1976) AD A030 458

PP 159
McConnell, James M., "The Gorshkov Articles, The New Gorshkov Book and Their Relation to Policy," 93 pp., Jul 1976 (To be printed in Soviet Naval Influence: Domestic and Foreign Dimensions, ed. by M. MccGwire and J. McDonnell; New York: Praeger) AD A029 227

PP 160
Wilson, Desmond P., Jr., "The U.S. Sixth Fleet and the Conventional Defense of Europe," 50 pp., Sep 1976 (Submitted for publication in Adelphi Papers, I.I.S.S., London) AD A030 457

PP 161
Melich, Michael E. and Peet, Vice Adm. Ray (USN, Retired), "Fleet Commanders: Afloat or Ashore?" 9 pp., Aug 1976 (Reprinted from U.S. Naval Institute Proceedings, Jun 1976) AD A030 456

PP 162
Friedheim, Robert L., "Parliamentary Diplomacy," 106 pp. Sep 1976 AD A033 306

PP 163
Lockman, Robert F., "A Model for Predicting Recruit Losses," 9 pp., Sep 1976 (Presented at the 84th annual convention of the American Psychological Association, Washington, D.C., 4 Sep 1976) AD A030 459

PP 164
Mahoney, Robert B., Jr., "An Assessment of Public and Elite Perceptions in France, The United Kingdom, and the Federal Republic of Germany, 31 pp., Feb 1977 (Presented at Conference "Perception of the U.S. — Soviet Balance and the Political Uses of Military Power" sponsored by Director, Advanced Research Projects Agency, April 1976)

PP 165
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